

**CLAIMS**

**What is claimed is:**

- [C1]**            1. A microfluidic delivery system for the transport of molecules comprising:  
                  a substrate;  
                  a reservoir in said substrate for containing the molecules;  
                  a fluid control device controlling release of said molecules from said reservoir; and  
                  a thin film inert impermeable coating applied to said substrate.
- [C2]**            2. The microfluidic delivery system according to claim 1 wherein said thin film inert impermeable coating is biocompatible.
- [C3]**            3. The microfluidic delivery system according to claim 1 wherein the molecules are comprised of drugs.
- [C4]**            4. The microfluidic delivery system according to claim 1 wherein said thin film inert impermeable coating is comprised of ultra-nanocrystalline diamond.
- [C5]**            5. The microfluidic delivery system according to claim 1 wherein said thin film inert impermeable coating is comprised of ceramic.
- [C6]**            6. The microfluidic delivery system according to claim 5 wherein said thin film inert impermeable coating is applied by ion-beam assisted deposition.
- [C7]**            7. The microfluidic delivery system according to claim 5 wherein

said ceramic is comprised of alumina.

[C8]

8. The microfluidic delivery system according to claim 5 wherein said ceramic is comprised of zirconia.

[C9]

9. The microfluidic delivery system according to claim 1 wherein said fluid control device is a permeable cap.

[C10]

10. The microfluidic delivery system according to claim 1 wherein said fluid control device is a disintegrating cap.

[C11]

11. The microfluidic delivery system according to claim 9 wherein said cap is comprised of electrically conductive ultra-nanocrystalline diamond.

[C12]

12. The microfluidic delivery system according to claim 1 wherein said fluid control device is a pump.

[C13]

13. The microfluidic delivery system according to claim 12 wherein said pump is an electrostatic pump.

[C14]

14. The microfluidic delivery system according to claim 12 wherein said pump is an electromagnetic pump.

[C15]

15. The microfluidic delivery system according to claim 12 wherein said pump is a pneumatic pump.

[C16]

16. The microfluidic delivery system according to claim 12 wherein said pump is a piezoelectric pump.

[C17]

17. The microfluidic delivery system according to claim 1 wherein

said fluid control device is a valve.

**[C18]** 18. The microfluidic delivery system according to claim 17 wherein said valve is an electrostatic valve.

**[C19]** 19. The microfluidic delivery system according to claim 17 wherein said valve is an electromagnetic valve.

**[C20]** 20. The microfluidic delivery system according to claim 17 wherein said valve is a pneumatic valve.

**[C21]** 21. The microfluidic delivery system according to claim 17 wherein said valve is a piezoelectric valve.

**[C22]** 22. The microfluidic delivery system according to claim 1 wherein said substrate is comprised of silicon.

**[C23]** 23. A microfluidic delivery system for the release of molecules comprising:  
a substrate;  
at least one reservoir in the substrate that is suitable to contain the molecules;  
the reservoir having a reservoir cap positioned on the reservoir over the molecules;  
wherein release of the molecules from the reservoir is controlled by said reservoir cap; and  
wherein said substrate is coated with a thin film of ultra-nanocrystalline diamond deposited on said biocompatible device wherein said thin film forms a biocompatible impermeably sealed substrate.

**[C24]** 24. The microfluidic delivery system according to claim 23 wherein

said molecules are released by diffusion through said reservoir cap.

**[C25]** 25. The microfluidic delivery system according to claim 23 wherein said molecules are released by disintegration of said reservoir cap.

**[C26]** 26. The microfluidic delivery system according to claim 23 wherein said substrate is comprised of silicon.

**[C27]** 27. The microfluidic delivery system according to claim 23 wherein said reservoir cap is comprised of a thin film of ultra-nanocrystalline diamond.

**[C28]** 28. The microfluidic delivery system according to claim 27 wherein at least a portion of said ultra-nanocrystalline diamond thin film is electrically conductive.

**[C29]** 29. A method of fabricating a microfluidic delivery system for release of molecules having reservoirs containing the molecules for release comprising:  
providing a substrate;  
depositing an ultra-nanocrystalline diamond coating on the substrate for use as an impermeable and biocompatible protective coating;  
filling the reservoirs with molecules to be release into living tissue; and  
capping the reservoirs with a cap material which retains the molecules.

**[C30]** 30. The method of claim 29 wherein said substrate is comprised of silicon.

**[C31]** 31. The method of claim 29 wherein said cap material is selectively permeable to the molecules.

**[C32]**

32. The method of claim 29 wherein  
said cap material disintegrates to release the molecules.

**[C33]**

33. The method of claim 29 wherein  
said cap material is comprised of ultra-nanocrystalline diamond.